DEPRESSIBLE HINGE AND MOBILE STATIONS USING SAME

FIELD OF THE INVENTION

The present invention relates generally to mobile stations, and more specifically to a mobile station including an opening member having one or more depressible portions for manipulating the mobile station between open and folded positions.

BACKGROUND

The manufacture and design of today's mobile stations (also known as mobile phones, PDAs, pagers, laptop computers and the like) is constantly evolving. Early mobile station designs were necessarily large and bulky. The radio communications equipment and battery units necessary for their operation generally were carried in one oversized unit; although in at least one early and cumbersome design the unit was actually divided into two pieces which were then connected by a power cable. Advances in integrated circuitry and electricity storage technology have enabled mobile station designers to create smaller and smaller devices. These instruments are not only lighter, but also less cumbersome and easier to transport. For example, mobile stations are no longer required to be permanently installed in automobiles or connected to bulky separately-carried battery packs. Essentially, today's smaller, more useful mobile stations have simply become more fashionable.

Unfortunately, several drawbacks have followed this new fashionability and convenience. For example, the increased mobility of today's mobile stations has the unintended drawback of subjecting these mobile stations to an ever-increasing number of potentially damaging environments. For modern day consumers, these environments include pockets, briefcases, purses, gym bags, glove compartments and toolboxes where the mobile station can contact harmful solid objects and moisture that may cause structural and/or cosmetic damage to the relatively delicate internal and operational elements (e.g., LCD displays, microphone and speaker ports, keypads, etc.) of the mobile station. Accordingly, mobile stations are highly susceptible to damage. To make matters worse, market forces continue to drive mobile stations smaller, therefore, making it more difficult to add bulky structural reinforcements that might protect the mobile stations.

This risk of damage is exacerbated by the number of externally accessible components that are provided on modern mobile stations. One of the most prominent of these components is the visual display. Initially, such displays were limited to small, light emitting diodes (LEDs) that indicated whether the mobile station was "on" or, regarding mobile phones, whether a call was in progress. Gradually, more advanced LED displays were developed that were capable of displaying a dialed telephone number, the current time, or other simple information. More recently, liquid crystal displays (LCDs) have become commonplace. An LCD is made by sandwiching an electrically sensitive liquid-crystal material between two very thin pieces of glass or other transparent materials. They are, therefore, easily susceptible to damage by even a relatively minor impact. Despite the hard, transparent cover or similar protective device, generally added to limit this vulnerability, LCDs remain one of the most easily damaged components in modern mobile stations.

The folded mobile station design has developed, in part, to provide greater durability to modern mobile stations. As will become apparent, folded mobile stations also provide

increased utility due to their relatively compact size. A folded mobile station is one that may be, generally speaking, folded from two parts into one more compact part. More specifically, as illustrated in FIGS. **1**A-**1**C, folded mobile stations **100** are generally comprised of a first functional component **101** and a second functional component **102**. The first and second functional components **101**, **102** are mechanically coupled to one another by a hinge assembly **175** such that each may be folded over the other in a clam-shell type action. Accordingly, folded mobile stations **100** possess an "open" and a folded or "closed" position.

FIG. **1**A provides one example of a conventional mobile station **100** (a mobile phone) oriented in the open position. As known to one of ordinary skill in the art, the first and second functional components **101**, **102** of the mobile station **100** include various internal circuitry and operational elements. For example, the first functional component **101** is depicted as including a LCD **150**. The LCD **150** is visible through, and protected by, a clear plastic cover **151**. A speaker port **154** is comprised of a series of small openings formed in the first functional component **101** adjacent to an internal speaker (not shown). The first functional component **101** also typically includes circuitry for driving the LCD **150** and internal speaker (not shown).

The second functional component **102** of a conventional mobile station **100** generally includes a microphone port **155** that is adjacent to an internal microphone (not shown). A keypad **160** is also provided that is comprised of a series of keys extending through a plurality of openings from an otherwise internally disposed key mat. As with the first functional component **101**, the second functional component **102** also houses the internal circuitry associated with the above described microphone **155** and keypad **160**. An antenna for facilitating radio frequency (RF) communications (not shown) may be located in either the first functional component **101** or the second functional component **102**, or may be distributed between them. Mobile station batteries (not shown) are typically stored in the second functional component **102**, due to the limited space available in the first functional component **101** as a result of the LCD **150** and speaker **154** placement. An external power supply (not shown), such as an AC adaptor, may be connected through a power port **144**. Similarly, external headphones (not shown) may be connected to the mobile station **100** at the external-device port **145**.

When the mobile station is "opened," the user has access to the keypad **160** and can conveniently place the speaker port **154** and microphone port **155** in a position for voice communication. The mobile station **100** may also be "closed" by folding the first portion **101** to meet the second portion **102** in a clam-shell action as indicated by the arrow. FIG. **1**B illustrates a known mobile station **100** in the closed position. Advantageously, the first functional component **101** and the second functional component **102** close in such a manner as to protect the keypad **160** and LCD **150**. Generally speaking, known mobile stations **100** cannot be used in a closed configuration, although such functionality may be achieved by employing an external microphone and speaker (not shown). Such devices are often used in 'hands-free' operation, and are readily connected through an external-device port **145**. As alluded to above, the folded design of modern mobile stations **100** is distinguishable over predecessors by accommodating safe storage on belts, in pockets, purses, or glove compartments without subjecting the sensitive internal components to damage from keys or other objects frequently encountered in such environments.